

**PROPOSED TEST PROTOCOL FOR CARBON MONOXIDE EMISSION
TESTING TO BE CONDUCTED ON
INTERMOUNTAIN POWER SERVICE CORPORATION'S BOILER
UNIT NO. 2 LOCATED IN DELTA, UTAH**

1.0 Introduction

1.1 Summary of Test Project

Overview

The Intermountain Power Service Corporation (IPSC) will perform stack testing pursuant to the requirements of permit conditions found in both the current Approval Order and Title V Operating Permit for the Intermountain Generating Station. Testing will consist of carbon monoxide (CO) determinations at varying operating conditions to verify the correlation between boiler excess oxygen and CO emissions agrees with earlier testing done on the Unit 1 boiler. This will set emission calculations for CO based on the operation of a newly installed over fire air system in the Unit 2 boiler.

1.2 Test Project Organization

Major lines of authority and communication are outlined below. The project team was organized along lines of authority which distributes responsibility for completing test activities among key individuals in the team structure. Each team member is ultimately responsible to the Plant Manager.

Plant Owner: Intermountain Power Agency
480 E. 6400 S.
Murray, UT 84107

Operating Agent: Los Angeles Department of Water & Power
111 Hope St
Los Angeles, CA 90012

Plant Operations & Contact:
Intermountain Power Service Corp
850 W. Brush Wellman Rd
Delta, UT 84624
435-864-4414

Plant Manager: George Cross, President & COO
Project Manager: Aaron Nissen, Sprvsing Performance Eng
Testing Coordinator: Aaron Nissen, Sprvsing Performance Eng
Data QA/QC: Lynn Banks, Env. Analyst

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Analytical QA/QC: Rand Crafts, Env. Analyst
Testing Team: Mike Ferrell, Env. Analyst
Rick Wright, Env. QC Technician
Rick Moody, Env. QC Technician
Ron Westlund, Env. Engineer
Robert Jeffrey, Lead Tech Analyst - Lab

Regulatory Agency: Utah Department of Environmental Quality
Utah Division of Air Quality
PO. Box 144820
Salt Lake City, UT 84114

1.3 Background and Testing Detail Overview

Description

IPSC will perform environmental testing to ascertain the correlation between boiler excess oxygen and over fire air (OFA) operating parameters and the resulting effect in CO emissions from the Intermountain Generating Station (IGS) stack. Specifically, we will verify how much CO emissions may increase at low O2 and high OFA flow. By performing this test, the DAQ and IPSC can be certain on a continuous basis that CO emissions calculations are accurately based upon certain parametric operating criteria such as O2 and OFA performance. Similar testing was performed on Unit 1 in September 2003.

The environmental testing is required pursuant to Condition II.B.2.h.1(6) of Title V Operating Permit #2700010002 (issued 4/6/2004), and Condition 10.D.(6) of DAQE-AN0327009-04 (issued 2/27/2004), both of which pertain to the installation of OFA at IGS. These conditions state:

"Initial stack testing (for CO) shall be performed on Unit #2 boiler. The stack test results shall be used to verify the overfire air system CO and O2 dependency relationship developed for the Unit #1 boiler and shall not be used for compliance determination.

(a)Frequency. Initial test shall be performed as soon as possible and in no case later than 180 days after the start up of OFA system installation on Unit#2 Boiler. The source may also be tested at any time if directed by the Executive Secretary.

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(b) Notification. The Executive Secretary shall be notified at least 30 days prior to conducting any required emission testing. A source test protocol shall be submitted to DAQ when the testing notification is submitted to the Executive Secretary.

The source test protocol shall be approved by the Executive Secretary prior to performing the test(s). The source test protocol shall outline the proposed test methodologies, and stack to be tested. A pretest conference shall be held, if directed by the Executive Secretary.

(c) Methods. Sample Location - The emission point shall be designed to conform to the requirements of 40 CFR 60, Appendix A, Method 1, or other methods as approved by the Executive Secretary. Access that meets the standards of the Occupational Safety and Health Administration (OSHA) or the Mine Safety and Health Administration (MSHA) shall be provided.

Volumetric Flow Rate - 40 CFR 60, Appendix A, Method 2.

Carbon Monoxide (CO) - CO shall be determined according to 40 CFR 60, Appendix A, Method 10, or other testing methods approved by the Executive Secretary.

(d) Production Rate During Testing. The production rate during all compliance testing shall be no less than 90% of the maximum production achieved in the previous three (3) years."

Specifically, stack CO testing will confirm that compliance with a block monthly average of 1320lbs/hr CO limit can be demonstrated by parametric monitoring. Those parameters, boiler excess O₂ and OFA operating status, dictate how CO emissions are to be calculated. Since IGS does not have continuous emissions monitoring systems (CEMS) for CO, that emission cannot be measured directly on a continuous basis. However, indicators may be used as an alternative that show the boiler is operating within parameters shown to meet compliance.

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IPSC undertook this testing effort on Unit 1 to correlate those operating parameters to actual CO emissions. A strong correlation was developed, and curves were established to show that correlation. This test is to confirm that relationship on Unit 2.

Methodology

The following specific testing procedures are proposed for this protocol:

The testing is proposed to be conducted on June 8, 9 & 10, 2004. This pretest protocol is being submitted to the UDEQ more than 30 days prior to testing.

Testing to be performed at the Intermountain Unit #2 Boiler Stack at 90 percent load or greater, as specified by permit.

IPSC will confirm and/or perform emission testing as set forth in the Code of Federal Regulations (CFR), Title 40, Chapter I, Part 60, Appendix A, with certain modifications. IPSC proposes to conform with the following:

- Method 1 - "Sample and Velocity Traverses for Stationary Sources"
- Method 2 - "Determination of Stack Gas Velocity and Volumetric Flow Rate (type "S" Pitot tube)"
- Method 3A - "Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure)"
- Method 4 - "Determination of Moisture Content in Stack Gases"
- Method 10 - "Determination of Carbon Monoxide Emissions from Stationary Sources"

Note that we are proposing to use Method 3A continuous sampling for CO₂ measurements from the stack, as opposed to Method 3 integrated sampling, as indicated by Method 10. Method 2 and Method 4 will be performed at the sample ports at the stack midlevel. Methods 3A and 10 will be performed on a sample

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extracted by heated umbilical from the stack midpoint sample ports. Method 2 shall be performed using Method 1 twelve point traverses. Methods 3A, 4 and 10 will utilize a three point traverse.

Additional parametric data relative to this testing shall be collected and compiled for submittal, including:

- Load (MWhe)
- Boiler Exit O2 (%)
- OFA Portional Flow Rate (%Ratio)
- OFA Damper Operating Position (%Open)
- Heat Input (mmbtu/hr Derived)

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2.0 Description of Source

2.1 Plant Operation

There are two identical steam generators at IGS. Each unit boiler is coal fired and output steam to a turbine rated at 950 megawatt-hour. Each boiler is a Babcock & Wilcox design generating 6,900,000 lbs/hr steam flow at 2,975 psi and 1,005 degrees F, and have a pulverized coal 48 burner opposed wall configuration. There are 8 overfire air ports on each opposing wall, with 6 ports above each burner, and two in each corner.

2.2 Pollution Control

Each boiler is outfitted with low-NOx burners and overfire air ports for control of nitrogen oxides generation.

The combustion gas exits the boiler into a fabric filter, followed by four induced draft fans, and then enters the wet flue gas desulfurization scrubber. The fabric filter provides high efficiency particulate control. The scrubber utilizes limestone slurry sprays to react with the sulfur dioxide and other acid gases to remove over 90% of those pollutants. The combustion gas is then discharged to the atmosphere through a 712 foot stack. Stack testing is done at the 352 ft. level inside the concrete chimney support structure holding two fiberglass flues.

2.3 Sampling & Monitoring Locations

Emissions sampling will be conducted from the midpoint of the chimney stack. The sample location meets 40 CFR Part 60, Appendix A, Method 1 criteria. The concrete stack contains two identical 28 foot diameter fiberglass flue liners. Sampling will be performed in the Unit 2 liner. Flue gas enters the chimney flue horizontally then turn 90 degrees to the vertical. The sample point is approximately 251 feet (9 times diameter) downstream above the bend in the flue, and 356 feet upstream from the exit (12 times diameter). Four equally spaced ports are located circumferentially at the sampling elevation. The sample location meets 40 CFR Part 60, Appendix A, Method 1 criteria as required by the IPSC permits for this testing.

Non-emission sampling for excess combustion O₂ will occur at the

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boiler exit passes, where O₂ is monitored by eight probes (four per path).

Performance indicators chosen for correlation with emission rates are limited to those that are presently electronically monitored and recorded. These include:

Load (MWhe)
Boiler Exit excess O₂ (%)
OFA Portional Flow Rate (%Ratio)
OFA Damper Operating Position (%Open)
Heat Input (mmbtu/hr Derived)

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3.0 Test Procedures

3.1 Test Conditions

Unit production rate will be at full load (950MW), steady state normal operation. The wet Fabric Filter and FGD scrubber will be in normal operation. The stack condition is saturated.

The overfire air system shall be operated at three various O₂ settings from 2% to 3.5%, in five distinct configurations across 15 thirty-minute runs:

- No OFA
- 1/3 Damper Open
- 2/3 Damper Throttled
- 2/3 Damper Open
- Full Open

3.2 Test Protocol

The IPSC testing team will perform stack testing following protocol outlined in 40 CFR Part 60, Appendix A, Methods 2, 3a, 4 and 10, with modifications outlined in this procedure. Three 30-minute test runs will be performed for each of the OFA operating configurations, at low, mid, and high boiler o₂ levels.

Quality assurance and quality control consist of following standardized testing and sample sheets, completion of protocol checklists, pre- and post-test meterbox calibration check, technical audits of testing and sampling equipment set-up and operation, and comparison of measured results against available stack monitored values as recorded by a continuous emission monitoring system.

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4.0 Test Results Reporting

4.1 Curve Correlation

CO emissions are to be determined by the general relationship:

$$[C_{ppmvd}] = n * (O_2\%)^a$$

Where:

$[C_{ppmvd}]$ = concentration of CO in parts per million
volume dry

n = curve specific factor obtained from the table
below

$O_2\%$ = percent O₂ measured at the boiler exit

a = curve specific exponent obtained from the table
below

Testing is being performed to confirm that CO relates to O₂
within the realm of the following values:

<u>OFA Operation</u>	<u>n</u>	<u>a</u>
No OFA	47259	-7.6817
1/3 Damper Open	66265	-7.9824
2/3 Damper Throttled	4029.2	-4.0112
2/3 Open	1372.4	-3.0919

4.2 Data Compilation

Testing and parametric data will be compiled in an EXCEL format,
and also tabulated and charted for easier analysis.

4.3 Correlative Analysis

The data will be graphed for each OFA operating configuration to

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show correlation and curve fit between boiler O₂ and CO.

The shape of curve is expected to be representative of actual conditions in the future. Additionally, as with Unit 1, a clear demarcation of what is outside of "Good Combustion Practice" is noted. Compliance with the CO permit limit can then be demonstrated based upon these values.

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5.0 Sampling and Analysis Procedures

5.1 Emissions Testing

Overview

IPSC will perform emission testing as set forth in the Code of Federal Regulations (CFR), Title 40, Chapter I, Part 60, Appendix A, with certain modifications. IPSC proposes to conform with the following:

- Method 1 - "Sample and Velocity Traverses for Stationary Sources"
- Method 2 - "Determination of Stack Gas Velocity and Volumetric Flow Rate (type "S" Pitot tube)"
- Method 3A - "Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure)"
- Method 4 - "Determination of Moisture Content in Stack Gases"
- Method 10 - "Determination of Carbon Monoxide Emissions from Stationary Sources"

Note that we are proposing to use Method 3A continuous sampling for CO₂ measurements from the stack, as opposed to Method 3 integrated sampling, as indicated by Method 10. Method 2 and Method 4 will be performed at the sample ports at the stack midlevel. Methods 3A and 10 will be performed on a sample extracted by heated umbilical. Method 2 shall be performed using Method 1 twelve point traverses. Methods 3A, 4 and 10 will utilize a three point traverse.

- A. EPA Method 1; sample and velocity traverses for stationary sources.

Figure 1b & 1c is a diagram of the Unit #1 & #2 Stack flues (Both flues are identical). This reference method requires that stack geometry and sampling points conform to Method 1 whereby representative sampling occurs with the other reference methods to be performed. The locations of these points relative to

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the stack are given in Table 1-2 of Method 1.

- B. EPA Method 2; for the determination of velocity, volumetric flow rate from stationary sources.

IPSC will conduct testing using methodology consistent with EPA Method 2. Twelve point traverses will be made concurrently with the three point traverses for Methods 3A, 4 and 10.

- C. EPA Method 3A; for gas analysis of carbon dioxide and oxygen using an instrumental method.

This reference method analyzes carbon dioxide simultaneously to CO. Sample is extracted by heated umbilical and delivered to instrumentation cluster utilizing RATA-certified equipment.

- D. EPA Method 4; for the determination of moisture content in stack gases.

Moisture in the stack gases is determined by passing the flue gas sample through collection impingers in an ice bath. Weight changes are recorded to calculate moisture content.

- E. EPA Method 10; for the determination of carbon monoxide from stationary sources.

CO will be measured by instrumental analyzer, with the effects of CO₂ discounted utilizing Method 3A for CO₂ determination, in lieu of Method 3 as discussed in Method 10.

An overview chart summarizing the test methods can be found in Figure 1a.

Data forms and electronic recording will be used to record readings from the tests. The data will be entered into a spreadsheet to compile and tabulate the results.

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6.0 Quality Control/Quality Assurance

6.1 Testing Procedures

The testing at the Intermountain Generating Station boiler stack #1 will be conducted by IPSC personnel in compliance with EPA Reference Method criteria and our pretest protocol. Deviations from the prescribed testing procedures will be noted.

6.2 Calibrations

Pre and post test calibrations of the instruments used will be performed and attached in the testing report.